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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/780,714	02/19/2004	Hirofumi Takikawa	TAKI3002/EM	3184

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EXAMINER

MIDKIFF, ANASTASIA

ART UNIT	PAPER NUMBER
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2882

DATE MAILED: 10/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/780,714

Applicant(s)

TAKIKAWA ET AL.

Examiner

Anastasia Midkiff

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 July 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3 and 5-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3 and 5-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

Claims 2-3, 9, 12, and 14 are objected to because of the following informalities:

With respect to Claim 2, Lines 4-5 recite, "diameters range from about 50 μm to about μm " wherein there is no lower range for the diameters. Claim 2 as originally presented read, "to about 1 μm " and the Examiner assumes that this is still the intended range, wherein the amended claim simply contains a typographical error.

Claims 3, 9, 12, and 14 are objected to based on their dependency upon Claim 2.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-3 and 5-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to Claims 1, 2, and 5, the limitation "size" renders the claim indefinite because it is unclear as to what boundary the limitation is defining, for example: thickness, length, width, thickness, or area of a structure. For examination purposes, the Examiner has defined "size" to mean thickness.

Claims 3 and 6-20 are rejected based on their dependency upon Claims 1, 2, and 5.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Xu et al. (US Patent 5,872,422; hereinafter Xu).

Re claim 1: As best understood by the Examiner, Xu discloses, in figure 1 and throughout the disclosure, a carbon substance comprising:

- a structure (14) having a size ranging from about 1 μ m to about 100 μ m (column 7, lines 64-67) and including carbon and a metal or metallic oxide (column 20, line 21); and
- a plurality of line-shaped bodies (20) whose diameters are smaller than about 200 nm (column 9, lines 44-48),
 - wherein the line-shaped bodies include carbon as a main component thereof and grow radially from a surface of the structure.

Re claim 8: Xu discloses, in figure 1 and throughout the disclosure, an electron emission element which emits electrons from an electron emission material by using a voltage difference between a first electrode and a second electrode, wherein the electron emission material is arranged on the first electrode and the second electrode is

arranged facing the electron emission material (column 18, lines 35-54), wherein the electron emission material comprises the carbon substance of claim 1.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 5, 16, 17, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu, and further in view of Nettleton (US Patent Application Publication 2003/0082092).

Re claim 5: As best understood by the Examiner, Xu discloses, in figure 1 and throughout the disclosure, a carbon substance comprising:

- a structure (14) having a size ranging from about 1 μ m to about 100 μ m (column 7, lines 64-67) and including carbon and a metal or metallic oxide (column 20, line 21); and
- a plurality of line-shaped bodies (20) whose diameters are smaller than about 200 nm (column 9, lines 44-48),
 - wherein the line-shaped bodies include carbon as a main component thereof and grow from a surface of the structure.

However, Xu fails to teach or fairly suggest the line-shaped bodies include at least one body starting from and returning to a same structure.

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Nettleton discloses, in figures 3a and 3b, the substitution of a carbon nanoloop for a carbon nanotube.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute a nanoloop for the nanotube of Xu because it increases the electron emission from the structure without increasing power to the device.

Re claim 16: Xu discloses, in figure 1 and throughout the disclosure, an electron emission element which emits electrons from an electron emission material by using a voltage difference between a first electrode and a second electrode, wherein the electron emission material is arranged on the first electrode and the second electrode is arranged facing the electron emission material (column 18, lines 35-54), wherein the electron emission material comprises the carbon substance of claim 5.

Re claim 17: Xu discloses, in figure 1 and throughout the disclosure, the line-shaped bodies (20) of the carbon substance are divided to direct in a radial manner.

Re claim 20: Xu discloses each of the line shaped bodies further includes a particle containing at least a metal or a metallic oxide (column 9, lines 23-24).

Claims 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Xu as applied to claim 1 above, and further in view of Smalley et al. (US Patent Application Publication 2002/0127162; hereinafter Smalley).

Re claim 11: Xu teaches all the limitations as shown above.

However, Xu fails to teach or fairly suggest a composite material comprising the carbon substance of claim 1 in a matrix.

Smalley discloses carbon nanotubes within a matrix (paragraph 25, lines 1-4).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the carbon substance of Xu within a composite material in a matrix because the matrix provides strength for the nanotube thereby preventing premature failure.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Xu and Nettleton as applied to claim 5 above, and further in view of Smalley.

Re claim 11: Xu and Nettleton teach all the limitations as shown above.

However, Xu and Nettleton fail to teach or fairly suggest a composite material comprising the carbon substance of claim 1 in a matrix.

Smalley discloses carbon nanotubes within a matrix (paragraph 25, lines 1-4).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the carbon substance of Xu within a composite material in a matrix because the matrix provides strength for the nanotube thereby preventing premature failure.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Xu as applied to claim 1 above, and further in view of Muroyama et al. (US Patent 6,991,949; hereinafter Muroyama).

Xu teaches all the limitations above, including a catalyst comprising Ni.

However, Xu fails to teach or fairly suggest a catalyst comprising both Ni and In.

Muroyama discloses a catalyst comprising both Ni and In (column 19, line 66-column 20, line 6).

It would have been obvious to one of ordinary skill in the art to substitute the catalyst of Muroyama for that of Xu because it provides a greater growth potential for the nanotubes.

The Examiner notes that the limitation "thermal decomposition...750C" is drawn to a product by process limitation. While the Examiner has addressed the implied structure produced by the process, a carbon substance, the process limitation is afforded no patentable weight. See MPEP 2113.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Xu and Nettleton, as applied to claim 5 above, and further in view of Muroyama et al. (US Patent 6,991,949; hereinafter Muroyama).

Xu and Nettleton teach all the limitations above, including a catalyst comprising Ni.

However, Xu and Nettleton fail to teach or fairly suggest a catalyst comprising both Ni and In.

Muroyama discloses a catalyst comprising both Ni and In (column 19, line 66-column 20, line 6).

It would have been obvious to one of ordinary skill in the art to substitute the catalyst of Muroyama for that of Xu and Nettleton because it provides a greater growth potential for the nanotubes.

The Examiner notes that the limitation "thermal decomposition...750C" is drawn to a product by process limitation. While the Examiner has addressed the implied structure produced by the process, a carbon substance, the process limitation is afforded no patentable weight. See MPEP 2113.

Allowable Subject Matter

Claims 2, 3, 9, 10, 12, and 14 would be allowable if rewritten or amended to overcome the objections and 35 USC 112, second paragraph, rejections set forth in this office action.

Claim 15 is rejected under 35 USC 112 (2), and also objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, and to overcome the 35 USC 112 (2) rejection set forth in this office action.

The following is a statement of reasons for the indication of allowable subject matter:

With respect to Claim 2, the best prior art of record teaches many of the elements of the claimed invention, including a carbon substance comprising: a plurality of structures, each having a size ranging from about 1 μm to about 100 μm and

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including carbon and a metal or metallic oxide; one or more line-shaped bodies whose diameters range from about 50 μm to about 1 μm , wherein the line-shaped bodies include carbon as a main component thereof and grow from the surfaces of the structures.

However, prior art does not teach or fairly suggest the carbon substance wherein at least parts of the line-shaped bodies connect two or more separate structures, in the manner required by Claim 2.

Claims 3, 9, 10, 12, and 14 would be allowable by virtue of their dependency upon Claim 2.

With respect to Claim 15, the best prior art of record teaches many of the elements of the claimed invention, including a carbon substance comprising: a plurality of structures, each having a size ranging from about 1 μm to about 100 μm and including carbon and a metal or metallic oxide; one or more line-shaped bodies whose diameters are smaller than 200 μm ; wherein the line-shaped bodies include carbon as a main component thereof and grow radially from the surfaces of the structures.

However, prior art fails to teach or fairly suggest the substance wherein the structure has a curved shape of a sphere, hemisphere, ellipse, or half ellipse, in the manner required by Claim 15.

Response to Arguments

Applicant's arguments filed 03 July 2006, regarding Claims 1, 8, 11, and 13 have been fully considered but they are not persuasive.

With respect to the 35 USC 112 (2) rejection of Claim 1, the Applicant asserts that the term "size" does not render the claim indefinite, as one of ordinary skill would know what was meant, and that it would be impossible to define size as "thickness" or "diameter" since the structure has varied shapes. The Examiner respectfully disagrees.

The term "size" denotes a specific dimension, such as length, width, thickness, area, etc. As written in the claim, it is not clear to one of ordinary skill in the art what dimension is being referred to by the term "size."

With respect to the 35 USC 102(b) rejection of Claim 1, as anticipated by Xu et al., the Applicant asserts that the prior art does not teach the invention, as it does not meet the limitation that the line-shaped bodies "grow radially" from a surface of the structure, owing to the fact that the structure of Xu et al. is a plane shape. The Examiner respectfully disagrees.

The shape of the structure is not claimed in Claim 1, and, as Applicant admits in their reply, the structure may be one of a various number of shapes. In this case, the broadest definition of "radial" that may be applied to all shapes is that each of the line-shaped bodies grows in a line drawn along a vector away from a point, which Xu et al. provides (Figure 1).

With respect to the 35 USC 103(a) rejection of Claim 5 as unpatentable over Xu et al. in view of Nettleton, Applicant asserts that Nettleton does not disclose a line shaped body starting from and returning to a same structure. The Examiner respectfully disagrees.

Nettleton shows a carbon nanoloop (Figs. 3a, 3b) wherein the end of the line-shaped carbon nanotube are connected to "a same structure", namely to itself. Nettleton teaches how to chemically modify the ends of such a nanotube to form a loop, and this could easily be done to attach it to another type of structure in the same manner. In addition to the motivation cited in the above and prior action, Nettleton also discusses the increased strength of nanotubes with the added benefits of the elasticity of a nanotube (Paragraphs 11 and 15).

With respect to the 35 USC 103(a) rejections over Smalley et al. and Muroyama et al., the Applicant asserts that no combination of these references, with or without Xu et al., teaches the invention of Claims 1, 5-8, 11, and 13. The Examiner respectfully disagrees.

The references teach the limitations of the Claims as cited above and in the prior office action.

Therefore the rejections of Claims 1, 5-8, 11, and 13 are maintained.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patents to: Keesmann et al. (USP# 5,773,921), Xu et al. (USP# 5,973,444), Zhou et al. (USP# 6,553,096), Pavlovsky et al. (USP# 6,664,728), and Kawate et al. (USP# 7,012,362), regarding carbon nanotubes used in emitter devices exhibiting radial growth; Nakamoto (USP# 6,891,320) regarding nanotube in emitter devices exhibiting radial growth on a curved surface; Yaniv et al. (USP# 6,531,828) regarding nanotube in emitter devices exhibiting radial growth and attachment to other structures; and Perlo et al. (USP# 7,018,261) regarding nanotubes used in a light source and forming a matrix.

U.S. Patent Application Publications to: Perlo et al. (PGPUB# 2003/0227243) regarding nanotubes used in a light source and forming a matrix; and to Lee et al. (PGPUB# 2004/0076576) regarding nanotube loops.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anastasia Midkiff whose telephone number is 571-272-5053. The examiner can normally be reached on M-F 7-4.

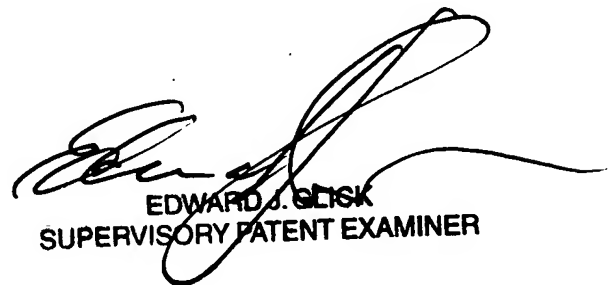
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on 571-272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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EDWARD J. GLICK
SUPERVISORY PATENT EXAMINER